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ORIGINAL RESEARCH

Population awareness of coronary artery disease risk factors in Jeddah, Saudi Arabia: a cross-sectional study

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Background: Coronary artery disease (CAD) is a serious cardiovascular disorder affecting middle-aged individuals. It is a major cause of death among adults over the age of 35 years. In Saudi Arabia, CAD is associated with higher mortality rate, and Saudi patients are reported to have significantly higher prevalence of risk factors for CAD than the Western population. Furthermore, as, to date, there is no definite cure for CAD, prevention of the disease and tight control of the known risk factors are the cornerstones for reducing CAD-associated mortality. Thus, the present work aimed to assess the population awareness of CAD risk factors in Saudi Arabia.

Methods: A cross-sectional study was conducted in Jeddah during the period January 2017 to December 2017 by using an online survey questionnaire to assess participants' awareness of 14 risk factors for CAD, namely: smoking, lack of physical activity, fast food and soft drink intake, television and computer use; history of diabetes mellitus, myocardial infarction and stroke; as well as a family history of diabetes mellitus, diabetes, hypertension, hyperlipidemia, CAD and myocardial infarction.

Results: Of 468 respondents, 41% were males. The mean age was 31.9±12.4. Approximately 86% were Saudi, and ~60% had a university education. The mean overall awareness score was 4.31±1.36 (1.00–8.00). Fast food, soft drinks, and family history of diabetes were the most commonly identified risk factors, reported by 74.8%, 64.3%, and 47.2% of participants, respectively. There was a strong correlation between overall awareness score and awareness of each risk factor individually ($P<0.003$).

Conclusion: There is an evident limited knowledge among the population in Jeddah, Saudi Arabia regarding the risk factors for CAD, and it is recommended that the healthcare sector in the country focus on public health education programs about the disease.

Keywords: population, public, awareness, coronary artery disease, risk factors, Jeddah, Saudi Arabia

Introduction

Coronary artery disease (CAD) is a serious cardiovascular disorder affecting almost half of middle-aged men and approximately one third of middle-aged women in developed countries.[1–4] Despite the notable reduction in coronary heart disease-associated mortality, it remains one of the major causes of death in adults over the age of 35 years.[3] In the Middle Eastern region, the prevalence of CAD has been reported to range from 5.4% to 13.4%.[5,6] There is a lack of data regarding the actual prevalence of CAD in Saudi Arabia specifically, but a prevalence of 5.5% was reported in 2004 among individuals between 30 and 70 years.[7] To date, despite the

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existence of highly effective therapies for CAD, all of them should be taken for life and a curative agent remains elusive, and, therefore, prevention is the cornerstone of efforts to reduce CAD-associated morbidity and mortality. For the prevention of CAD, tight control of risk factors is critical. Several risk factors for CAD have been identified. They are either modifiable risk factors (such as hypertension, hypercholesterolemia, smoking, diabetes mellitus, lack of physical activity, obesity, and psychological stress) or non-modifiable risk factors (such as old age, male gender, family history of CAD, and certain ethnicities).[8]

It should be noted that the burden of CAD risk factors is significantly high in the Middle Eastern region, including Saudi Arabia.[9] The mean age for CAD in the Middle East has been found to be 10 years younger than the mean age for the disease worldwide.[9] It was also noted that patients in the Middle East have at least three risk factors for the disease. In addition, hypertension was prevalent in >80% of these patients, diabetes and smoking were prevalent among approximately half of the patients, and dyslipidemia was prevalent among at least one third.[9] Furthermore, the vast majority of those patients had at least one uncontrolled risk factor reflecting poor awareness about the disease.[9] A study in Saudi Arabia reported similar findings and data, where approximately half of patients had at least three risk factors, hypertension and obesity were found in half of the patients, and three quarters had dyslipidemia.[10]

Knowledge and awareness about the risk factors for CAD, not only among physicians but also among the general public, are essential for the prevention of the disease. The aim of the present work was to assess public awareness levels of the risk factors for CAD in Jeddah, Saudi Arabia.

Methods

This was a cross-sectional study conducted at King Abdul Aziz University in Jeddah, Saudi Arabia during the period from January 2017 to December 2017. The study was conducted by distributing an online survey questionnaire to 500 participants, who were members of the public. Participants were selected through volunteer sampling, and a survey questionnaire was given to them to complete. No age or sex restrictions were applied to the questionnaires. Any volunteer was welcome to complete the study questionnaire. The questionnaire consisted of two sections: one to collect sociodemographic characteristics and another for assessment of awareness about CAD risk factors. At the end of the questionnaire, an email was provided for contact in case the participants had inquiries about any unclear questions.

The socioeconomic variables included in the questionnaire were participants' age, sex, nationality, marital status, employment, education, and income. Family and personal medical history, such as diabetes mellitus, hypertension, and dyslipidemia (high cholesterol or triglycerides levels), was also included in the questionnaire. Awareness of CAD risk factors was assessed through yes/no questions asking whether or not the participants believed certain factors were risk factors for CAD. Fourteen risk factors were included in the questionnaire, namely: smoking, lack of physical activity (at least 3 minutes walking 5 times a week), fast food and soft drink intake, television and computer use; history of diabetes mellitus, myocardial infarction and stroke; as well as a family history of diabetes mellitus, diabetes, hypertension, hyperlipidemia, CAD and myocardial infarction. Each participant was given an awareness score that was calculated from the number of cardiac risk factors he/she knew. One point was assigned for awareness of each of the 14 previously mentioned risk factors; thus, the total score ranged from 0 (for patients who did not recognize any of the 14 risk factors) to 14 (for patients who were aware of all the questioned risk factors) (see Supplementary material).

All data were input to the computer and analyzed using the Statistical Package for Social Science (SPSS) software, version 23.0 (IBM Corporation, Armonk, NY, USA). Categorical variables were presented as frequencies and percentages. Continuous variables were presented as mean ± SD. Awareness score was presented as mean ± SD, minimum and maximum values. The continuous variables were tested for normality by Kolmogorov–Smirnov test and Shapiro–Wilk test. According to these tests the data were non-normally distributed. Correlation between age of the respondents and awareness score was calculated using Spearman's correlation test. Comparisons between the mean awareness scores across the demographic variables were carried out via Mann–Whitney U test (for dichotomous variables) and Kruskal–Wallis test (for demographic characteristics with more than two attributes). Finally, comparison of mean awareness scores was carried out for each of the cardiac risk factors (aware/not aware) using independent sample t-tests. The study data set was complete; therefore, missing data management was not required, and the analysis was performed at a 95% CI.

This study was approved by the Unit of Biomedical Ethics Research Committee at King Abdulaziz University, and it was conducted in accordance with the Declaration of Helsinki. Participants were prompted to reply to a question as to whether they consented to completion of survey or not. Only those who replied "yes" could move on to the questions of the survey. Those who replied "no" did not complete the

survey. Completion of the survey was completely voluntary. No personal data that could reveal the participants' identity were collected. Data were strictly protected for confidentiality when conducting this study. Ethical approval was obtained prior to starting data collection.

Results

Of the 500 questionnaires distributed, a total of 468 participants responded. Male participants comprised 41.2% of the recruited participants (n=193). Most of the respondents (85.7%) were Saudi Arabian. The mean ± SD age of all study participants was 31.9±12.4 years. Most of the respondents (59.6%) had a university degree. More than half (54.1%) of the respondents were married, and 60.3% were unemployed. In regard to income, 43.8% had a yearly income of <15,991 dollars, 26.1% had an income between 15,991 and 31,982 dollars, and 30.1% had an income <31,982 dollars/year (Table 1). The demographic variables were not statistically significantly different among the studied participants (all *P*-values are >0.05) (Table 2).

Regarding awareness of risk factors, the awareness scores ranged from 1 to 8 with a mean ± SD of 4.31±1.36. None of the participants scored more than 8 points when measuring awareness. Fast food intake was found to be the risk factor that the respondents were most frequently (74.8%) aware of. Personal history of stroke was the least known CAD risk

Table 1 Demographic characteristics of all respondents (n=468)

Characteristics	N (%)
Sex	
• Male	193 (41.2)
• Female	275 (58.8)
Nationality	
• Saudi	401 (85.7)
• Non-Saudi	67 (14.3)
Level of education	
• University	279 (59.6)
• Secondary school	161 (34.4)
• Intermediate school	21 (4.5)
• Primary school	7 (1.5)
Marital status	
• Single	200 (42.7)
• Married	253 (54.1)
• Separated or divorced	15 (3.2)
Employment status	
• Employed	186 (39.7)
• Unemployed	282 (60.3)
Income	
• <1,332 USD	205 (43.8)
• 1,332–2,665 USD	122 (26.1)
• >2,665 USD	141 (30.1)

Table 2 Comparison of the awareness score across the demographic characteristics among participants' groups (n=468)

Characteristics	Mean ± SD	*P*-value
Age (in years)	31.9±12.4	0.319
Sex		
• Male	4.37±1.42	0.495
• Female	4.28±1.32	
Nationality		
• Saudi	4.34±1.35	0.223
• Non-Saudi	4.16±1.46	
Level of education		
• University	4.25±1.33	0.688
• Secondary school	4.39±1.43	
• Intermediate school	4.52±1.17	
• Primary school	4.43±1.72	
Marital status		
• Single	4.35±1.30	0.281
• Married	4.32±1.42	
• Separated or divorced	3.80±1.21	
Employment status		
• Employed	4.28±1.31	0.960
• Unemployed	4.33±1.40	
Income		
• <1,332 USD	4.22±1.29	0.443
• 1,332–2,665 USD	4.39±1.41	
• >2,665 USD	4.39±1.43	

factor (0.9% respondents were aware of it). Awareness of the different CAD risk factors studied is presented in Table 3.

Awareness of each of the risk factors included in the questionnaire was studied in comparison with the mean awareness score. Table 4 presents these comparisons. It was noted that awareness of each risk factor for CAD was significantly correlated with the overall awareness (all *P*-values <0.03). For instance, the overall awareness score among patients who knew that smoking was a risk factor for CAD was 4.94±1.39, while the mean awareness score among those who did not know that smoking was a risk factor was 4.09±1.28 (*P*<0.001). Similarly, the overall awareness among patients who knew whether each of the factors presented was a risk factor for CAD was significantly higher than among those who did not. Figure 1 illustrates the mean awareness scores for all studied risk factors.

Discussion

The present work has shown that there is an evident lack of knowledge and awareness of CAD risk factors among the public in Saudi Arabia. It is well-established that adequate knowledge and awareness about the individual risk factors for developing CAD are essential for the prevention of the disease and for the reduction of its mortality.[11,12] Population

Table 3 Awareness of risk factors for coronary artery disease of all respondents in frequencies and percentages (total 14 risk factors) (n=468)

Awareness of CAD risk factors	N (%)
Smoking	
• Yes	122 (26.1)
• No	346 (73.9)
Lack of physical activity	
• Yes	182 (38.9)
• No	286 (61.1)
Fast food intake	
• Yes	350 (74.8)
• No	118 (25.2)
Soft drink intake	
• Yes	301 (64.3)
• No	167 (35.7)
TV watching	
• Watch TV	183 (39.1)
• Do not watch TV	285 (60.9)
Computer using	
• Use computer	135 (28.8)
• Do not use computer	333 (71.2)
Having DM	
• Yes	56 (12.0)
• No	412 (88.0)
Personal history of MI	
• Yes	7 (1.5)
• No	461 (98.5)
Personal history of stroke	
• Yes	4 (0.9)
• No	464 (99.1)
Family history of DM	
• Yes	221 (47.2)
• No	247 (52.8)
Family history of HTN	
• Yes	174 (37.2)
• No	294 (62.8)
Family history of hyperlipidemia	
• Yes	98 (20.9)
• No	370 (79.1)
Family history of CAD	
• Yes	19 (4.1)
• No	449 (95.9)
Family history of MI	
• Yes	167 (.35.7)
• No	301 (64.3)

Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension; MI, myocardial infarction; TV, television.

awareness about modifiable risk factors is the primary strategy for reducing the incidence and prevalence of the disease.[13–15] While the vast majority of the respondents who completed the study questionnaire were highly educated (59.6% had a university education), the highest overall awareness score was 8. The overall awareness score for the 14 risk factors included in the study questionnaire ranged from 1 to 6, with a mean of 4.31±1.36. Of the 468 participants, none could identify more than eight of 14 risk factors for CAD. The mean age of the studied sample was 32 years. This young age may be due to the fact that the survey was distributed online, and most of the elderly individuals in Saudi Arabia do not use the Internet. Similar to these results, much of the literature from developing African countries and Middle Eastern countries has reported inadequate awareness of CAD risk factors among the general public.[16–19] For instance, Ammouri et al reported that among 114 participants from Oman studied in 2012, ~60% had low knowledge scores regarding risk factors for CAD.[20] Similarly, Aminde et al, in their study of 1,162 participants from Cameroon, reported a significant lack of knowledge among more than half of the recruited participants (53%).[21] However, dissimilar to the results of the present study, both of the aforementioned studies reported that a high level of education was associated with a better awareness about CAD risk factors.[20,21]

While the general knowledge and awareness of CAD risk factors appear to be very poor among the Middle Eastern and African countries, reports from Western countries and the United States are different.[12,19,22] In a study conducted in 1,702 American citizens, approximately half of the participants had adequate knowledge about CAD. The survey included questions about seven risk factors for CAD, and 37% of respondents could identify all seven risk factors; average participants could identify 4.9 factors.[23] Another study conducted two decades ago (from 1993 to 1995) in the United Sates reported that, among 3,226 American–Indian participants, awareness about risk factors for CAD was as high as 90% for many risk factors.[24] The lack of knowledge and awareness among the patients recruited in this study and among the Middle East in general may reflect inadequate public health education, and this indicates the necessity of urgent intervention from healthcare authorities in the Middle East region to educate the public about coronary heart disease.

In the current study, negative dietary behaviors (such as fast food intake and soft drink intake) were the most commonly identified risk factors among the study participants. Diabetes mellitus, smoking, and lack of physical activity were identified by only 12%, 26%, and 39% of participants, respectively. Family history of diabetes was the most common family disease known to be a risk factor for developing CAD; it was identified by 47.2% of participants. Family history of hypertension, dyslipidemia, CAD, or MI was less commonly identified. The lowest risk factor for CAD identified among participants was personal history of cerebrovascular stroke; <1% of the studied participants were aware that stroke is a

Table 4 Relationship between mean awareness score and knowledge regarding CAD risk factors. (n=468)

S No	CAD risk factors	Awareness	Mean ± SD	P-value
I	Smoking	Yes	4.94±1.39	<0.001
		No	4.09±1.28	
2	Physical activity	Yes	4.86±1.28	<0.001
		No	3.96±1.30	
3	Fast food intake	Yes	4.56±1.27	<0.001
		No	3.58±1.38	
4	Soft drinks intake	Yes	4.76±1.24	<0.001
		No	3.51±1.19	
5	TV watching	Yes	4.84±1.34	<0.001
		No	3.98±1.34	
6	Computer using	Yes	4.69±1.32	<0.001
		No	4.16±1.35	
7	Having DM	Yes	5.11±1.74	<0.001
		No	4.21±1.27	
8	Personal history of MI	Yes	6.14±1.07	0.001
		No	4.29±1.35	
9	Personal history of stroke	Yes	7.00±0.82	0.001
		No	4.29±1.34	
10	Family history of DM	Yes	4.71±1.44	<0.001
		No	3.96±1.19	
II	Family history of HTN	Yes	4.93±1.39	<0.001
		No	3.93±1.20	
12	Family history of hyperlipidemia	Yes	1.39±0.14	<0.001
		No	4.01±1.18	
13	Family history of CAD	Yes	5.21±1.40	0.003
		No	4.28±1.35	
14	Family history of MI	Yes	3.89±1.12	<0.001
		No	4.54±1.43	

Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension; MI, myocardial infarction; TV, television.

risk factor for CAD. While the public in other Arab countries, such as Oman, have poor knowledge about CAD risk factors, as previously mentioned,[18,20] awareness in Saudi Arabia seems to be even poorer. Approximately 98.3% of participants in the Omani study knew that smoking is a risk factor for CAD, vs only 26.1% in Jeddah, Saudi Arabia.[20] Lack of physical activity, fast food intake, history of diabetes mellitus, and family history of CAD were identified as risk factors for CAD by 91.2%, 75.4%, 63.2%, and 59.7% of participants from Oman, respectively, in comparison with 38.9%, 74.8%, 12%, and 4.1% in the current study. In a study in the United States, the most commonly recognized risk factors for CAD were found to be obesity, hypertension, and dyslipidemia (identified by more than three quarters of participants), while diabetes mellitus, dietary habits, and exercise were identified by only ~65% of participants.[23]

Notably, the overall awareness scores for the participants in this study were significantly positively correlated with awareness of each factor separately. Participants who knew that smoking, diabetes, lack of physical activity, poor dietary habits, history of MI, history of cerebrovascular stroke, or family history of diabetes, dyslipidemia, hypertension, or CAD were more likely to have higher general awareness scores, ie, they were aware of more risk factors than patients who did not identify these factors as being CAD risk factors. This confirms the importance of educating the public in Saudi Arabia about CAD, its risk factors, and its prevention strategies. The results of this study indicate that educational efforts should be made that target different populations in Saudi Arabia, particularly those of lower socioeconomic classes, as approximately of the participants had low financial income.

The strengths of this research are that the questionnaire used generated a high response rate. Also, the absence of statistically significant differences between the demographic characteristics of the studied population may suggest that the study included participants from different social, educational, and occupational classes to an equal extent. The main weaknesses of the study are non-validation of the study questionnaire, and the voluntary recruitment of participants from the public, without randomization. Another limitation
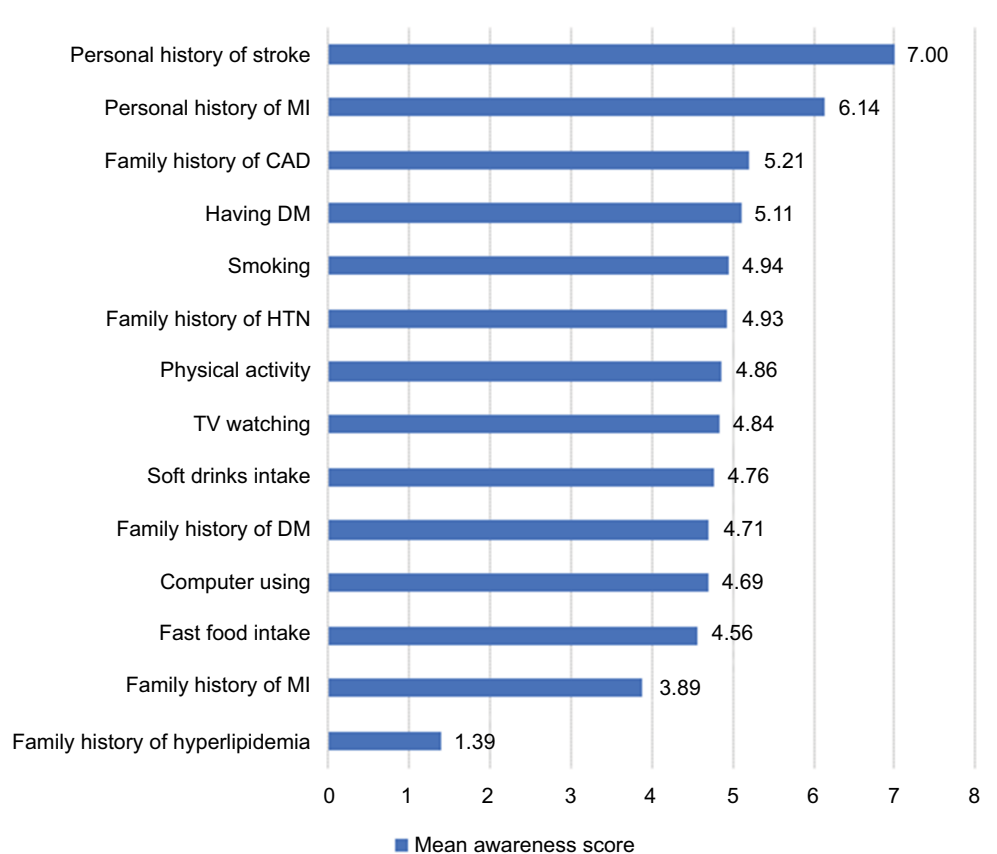
Personal history of stroke	7.00
Personal history of MI	6.14
Family history of CAD	5.21
Having DM	5.11
Smoking	4.94
Family history of HTN	4.93
Physical activity	4.86
TV watching	4.84
Soft drinks intake	4.76
Family history of DM	4.71
Computer using	4.69
Fast food intake	4.56
Family history of MI	3.89
Family history of hyperlipidemia	1.39

■ Mean awareness score

Figure 1 Mean awareness scores for all studied risk factors.
Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension; MI, myocardial infarction; TV, television.

is that the study was a cross-sectional study which may have led to differential misclassification Therefore, the results of this study cannot be generalized to the whole population, and further studies are recommended to be conducted on a multicentric basis to cover different types of hospitals and wider population.

Conclusion

There is an evident lack of awareness of CAD risk factors in Saudi Arabia. The vast majority of the studied population could not identify more than one third of the CAD risk factors. Therefore, educational efforts should be made to increase the level of awareness of the Saudi population about CAD to reduce the incidence and prevalence of this serious disease.

Disclosure

The authors report no conflicts of interest in this work.

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Supplementary material

Survey Questions	
1. Age:	***2. Sex*** □ Male □ Female
3. Nationality □ Saudi □ Non-Saudi	***4. Marital Status:*** □ Single □ Married □ Separated/Divorced
5. Employed: □ Yes □ No	***6. Income*** □ <1332 $ □ 1332-2665$ □ >2665$
7. Education □ University Secondary School □ Intermediate School □ Primary School	

Which of the following is a risk factor for coronary artery disease?
1. Smoking □ Yes □ No
2. Lack of physical activity (at least 3 minutes of walking 5 days per week) □ Yes □ No
3. Fast food intake □ Yes □ No
4. Soft drink intake □ Yes □ No
5. Hours spent weekly watching TV □ Do not watch □ Less than 14 hours □ more than 14 hours
6. Hours spent weekly on computer □ Do not use □ less than 14 hours □ more than 14 hours
7. Personal history of diabetes □ Yes □ No
8. Personal history of stroke □ Yes □ No
9. Personal history of heart attack diagnosed by a physician □ Yes □ No
10. Family history of diabetes □ Yes □ No
11. Family history of hypertension □ Yes □ No
12. Family history of hyperlipidemia (high cholesterol or triglycerides level) □ Yes □ No
13. Family history of heart attack diagnosed by a physician □ Yes □ No
14. Family history of coronary artery disease diagnosed by a physician □ Yes □ No